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THE INDUSTRIAL SITUATION IN NEW ENGLAND

By Dudley Harmon*

(Presented at a meeting of the Boston Society of Civil Engineers, October 15, 1930)

Mr. President and Members: Next month will mark the fifth anniversary of the first gathering which led to the creation of the New England Council. This fact has led us to review the situation and see what conditions were before the creation of the Council and what they are at present.

In 1925 the morale of New England was low. When a New England father will tell his son to leave New England and seek better opportunities elsewhere, that is an extremely serious situation. This was the situation in New England a few years after the war. Our troubles were being very widely advertised, and the rest of the country was believing and saying that New England had passed her peak industrially and had only decline ahead. Our own people were beginning to accept this pessimistic view and to act accordingly. Our newspapers regularly reprinted all the dire prophecies concerning New England that were published elsewhere, and this in turn added to the weakened morale of our own people. Something had to be done.

All attempts to get New England together had been a failure, but t was felt that through the New England Governors co-operative and definite action might be had. So in 1925 the Governors appointed a oint committee to devise some means whereby New England interests could work together toward a solution of the economic problems common to the New England area.

The committee appointed by the Governors called a "town meeting" of qualified representatives from the agricultural, commercial and industrial organizations of the New England States. They put in two days at Worcester discussing New England's problems. This First New England Conference was made an annual institution, and the New England Council of seventy-two men was created, twelve from each state. They form a very good cross section of the major economic activities of these six states, — newspaper men, manufacturers, publishers, farmers, railroad men, bankers, and so on.

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* Executive Vice-President of the New England Council, Statler Building, Boston.

These men soon found that New England was unable to resist pessimistic propaganda chiefly because it did not have the facts about its own conditions. Even had it possessed the facts it had no means of disseminating them to its own people and the rest of the country.

Summing up the work of the past five years I should say that the two most important accomplishments of the Council were supplying those two needs. First, the Council set itself to work to get at the facts about New England. The Department of Commerce, at our request, made a most comprehensive study of New England's economic development — in fact, the most comprehensive study ever made of any area in the United States. Now we can give the man in Bangor or the man in Bridgeport the same facts about New England. We now know just what we produce and how much. We know the buying power of our market, and how that market is supplied. We can furnish business information about New England or any part of it. Equally important, we have also set up means for getting our facts before the business world.

It seems to me the Council's activities in the last four or five years may be expressed in engineering terms as an endeavor to apply to some of our economic problems the forces of co-operation. I do not know that co-operation is a force recognized in engineering schools, yet I feel sure that you, as practical business men, will agree that co-operation is a real force. The Council has tried to organize and apply that force to some of our New England problems. For example, it was at the request of the Council that the United States Department of Commerce made its economic surveys of New England, and thus made available the facts which New England needed. Before the Council came into existence there was no agency to ask the co-operation of the Department of Commerce, and no agency with which the Department could work in carrying out such surveys. This particular problem was solved for both the government and New England by applying the force of co-operation.

The Departments of Agriculture were working on problems identical with those in adjoining states; yet they had never worked together or conferred on their common problems. Bringing those commissions of agriculture together, the Council put up to them for the first time this question: "What is the big problem in agriculture today in New England?" Their answer was, "The marketing problem." Seeing the problem, they worked out a program which is now in operation with great success.

Each New England state legislature passed a law providing that the Commissioner of Agriculture might, in consultation with the producers, establish quality standards for agricultural products. Then they devised a label for use throughout New England in identifying products meeting these standards. These labels are a guarantee of quality.

Three or four years ago the highest priced eggs in the Boston market were laid in California, 3,000 miles away. That was not because the California egg was better, but because the California poultryman had proved himself a better merchandiser. He was getting a premium for California eggs no better than the eggs produced here, because he had set up a standard, identified the eggs conforming to that standard, and packaged them attractively. The market in Boston was perfectly willing to pay several cents extra for the California eggs of guaranteed, uniform quality.

Since the introduction of the New England label, nearly 4,000,000 labels have been bought and used by New England producers. The ultimate objective is to have a very large part of the quality products of New England farms sold under the New England quality label, and thus bring a premium to New England producers. This does not mean raising the cost of living in New England. There is and always will be a large market here for quality products. The object is to secure for New England farmers that quality market which yields the highest return.

This practical program is another illustration of the force of cooperation to the working out of the New England problem. The fundamental conditions of New England agriculture have not been changed by anything the Council has accomplished, but there are scores of our farmers who now enjoy better returns for their labor than ever before, and that is the result we are after.

The Council said to the power companies: "You are located in New England and you have enormous investments in the territory you are serving. The growth of your business depends upon the growth and prosperity of your territory. Therefore you have a very real interest in the growth of the communities you are serving, and we think you ought to so organize yourselves that you can assist and protect and foster that growth in every way. Thirty-five per cent of New England's income is derived from manufacturing industries. Probably that same ratio will obtain in the future, which means that the best opportunity you have for growth is either to attract to your territory new industries or help the expansion of existing industries. Therefore we suggest you assign trained men to help promote the industrial growth of the territory in which you operate."

The larger power companies saw the point right away, and acted promptly. The smaller companies did not see so quickly and could not act so vigorously. But there are now 104 power companies which have assigned personnel to assist in promoting the industrial development of the areas they serve. Some of the reports you read in the newspapers about new industries coming to Boston are due to these efforts.

Each New England railroad company now has its industrial bureau or some equivalent organization working to promote agricultural and industrial development. When the Council started there was hardly one such bureau.

We asked the banks to help the manufacturers by displaying in their windows or lobbies exhibits of locally manufactured products. Many of the banks are now doing this, and believe it worth while. Most banks are regular advertisers. You may have noticed facts about New England and its industries in the recent advertising of some of the Boston banks. The Second National Bank published such an advertisement the other day, and the Atlantic National Bank has devoted a whole series to New England, thus testifying to their faith in New England. The National Shawmut Bank is now inaugurating a campaign in which stories of the business success of New England firms are set forth. Conrad's store also has broadcast constructive facts about New England in its advertising in Boston papers. Many other examples could be cited.

Those advertisements represent the expenditure of thousands of dollars in the course of the year — far more money than the Council could hope to have available for advertising New England. They demonstrate how the Council enlists the co-operation of business interests in building up business confidence in New England.

There is a great insurance company doing business here in New England, — the Metropolitan Life. It was so impressed by the work of the Council that it came to us and asked, "What can we do to help?" Following our suggestions, they spent some $40,000 in digging out examples of the successful application of research methods to the solution of manufacturing problems in New England industries. The results were published in a series of reports, widely distributed not only in New England but in other industrial areas, thus advertising the accomplishments of progressive New England industries.

The National Research Council organized this year a ten-day tour of some of the leading industrial laboratories in America. Learning of our interest in research they offered New England twenty-five places in the party. Out of 103 persons on the trip New England actually furnished 32. That means a considerable expenditure of time and money for those men. Three years ago we could not have persuaded six men in New England to go on such a trip. In other words, we have succeeded in increasing interest in research methods among our manufacturers.

Last winter President Hoover summoned a group of business leaders to the White House to consider the situation created by the collapse in security values. We felt very much honored that the President of the Council was included in that invitation. You will remember the suggestions for the stabilization of industry that resulted from that conference. The Council, through its Industrial Committee, developed a program of concrete measures for maintaining employment through repair and modernization of plant, shortening hours, and other suggestions based on the recommendations of the President's conference. This program was placed before some 3,000 New England manufacturers, and their co-operation invited. Later we asked these manufacturers to tell us what they were doing, and their reports showed definite results which helped materially to alleviate the effects of the business recession.

The depression did not end in the spring, as many thought a year ago that it would. Our Industrial Committee thereupon followed up its original suggestions with a program for stimulating more aggressive merchandising on the part of manufacturers. This program attracted nation-wide attention and brought definite results helpful to New England business.

About the general industrial stiuation in New England, I haven't any words of cheer to bring you. You all know the situation just as well as I do. This afternoon I heard of a company in Rhode Island with several plants. All of those plants are operating full time, and not only operating full time, but making money. In every state in New England and in almost every industry I could point out certain plants which are operating full time and making money, even during this time of depression. These plants are by no means typical, however. Some industries are only operating thirty-five hours a week, with a reduced personnel as well. There is no predominant tone in New England industries today that we can discover. The situation is mixed; it is unsafe to draw general conclusions.

But I can say this: People from outside New England feel, as do also those in New England who make it their business to study conditions, that New England is coming through this depression better than the other industrial areas with which it is chiefly in competition. There is some statistical support for that impression.

It so happens that one of our great public service corporations in the last few years has been at some pains to make some really comprehensive studies of New England. On the basis of these studies it has made some predictions as to New England in 1940 and 1950. They find the prospect, on the whole, very favorable. Their conclusion is that in 1950 New England will have a population of 10,000,000 people, — a gain of about 20 per cent in twenty years.

It is estimated that after 1935 the cotton textile production in New England industry which has been diminishing will start up again. The present shrinkage will continue a little longer, and then an upward movement will come, and in 1950 the estimated volume of textile manufacture and the volume of people employed in it in New England will be materially greater than now. The silk industry, as charted by that research, is due for an increase in volume of output and the number of persons employed in the next twenty years. The shoe industry, according to this estimate, will see changes. New England will not retain as large a share as she used to have. She once had 60 per cent and now has 35. But the actual production of shoes in New England, it is believed, will show a steady increase during the next twenty years.

Here is an estimate that will probably surprise you. Rubber manufacturing in New England has shown a very healthy growth. The rubber industry is charted for an increase of over 50 per cent in the next two decades. Another industry for which healthy growth is predicted in the next ten or twenty years is the manufacture of electrical goods.

But the class for which the largest growth is predicted is a class hard to define because it is so miscellaneous in character. Perhaps it could best be described as the manufacture of gadgets. Mr. Hoover in discussing the New England situation with the Council said that our hope lay in the manufacture of specialties in which labor is the chief item of cost, and materials the least important item. The studies to which I have referred indicate that the greatest gain in our industrial activity will come from the increasing manufacture of specialties.

Discussion

Mr. Lewis E. Moore:[*] I am sure we are all very grateful to Mr. Harmon for coming here tonight and talking on the conditions in New England. No doubt he will be glad to answer questions any one may wish to ask.

His remark about New England manufacturing gadgets reminds me that I have heard there are various brass concerns in Bridgeport which are working double time — not an unhealthy sign.

Mr. S. Stanley Kent:[†] Did this survey or study take into account the effect of recreational industries in New England?

Mr. Harmon: That played a very important part. The development of recreational resources provides added employment and produces additional taxable wealth. That was definitely taken into consideration and definitely regarded as a capital asset and part of the income earning power of New England.

We publish every year a directory of the recreational literature and sources of recreational information in New England. Until the Council took up the work nobody knew what was published by way of selling New England's summer attractions. So we brought all of them together and listed them in as attractive form as money would permit, and circulated 100,000 copies of this directory over the country.

I think the Council has developed among all interests in New England a recognition that our recreational resources are a capital asset and should be recognized as such; also that they are a potential market for selling manufactured products. In the State of Massachusetts last year the Governor appointed a Commission charged with the task of promoting Massachusetts agricultural, industrial and recreational resources. The Council was primarily responsible for this action. In Rhode Island the same thing has been done.

We submit our recreational directory to the New England manufacturer each year, and say to him, "Why don't you send this to all your customers in different parts of the United States with the suggestion, 'You may be planning a vacation in New England. This may help you to decide. When you come, stop in at our plant and look it over.'"

Some of our insurance companies also distribute the booklet in this way: we say to the manufacturer, "All the world passes by your doors. Why don't you put a sign up?" I am glad to say the crop of signs on our factories is showing a very noticeable increase, largely due to that stimulation.

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[*] Consulting Engineer, 73 Tremont Street, Boston.

[†] Assistant Engineer, Proprietors of the Locks and Canals, Broadway, Lowell, Mass.

We suggest, also: "Are you making sure that your product is on display in the local stores?" "When visitors come to New England this summer, invite them to the factory. Show them your goods. Get them interested."

Those of you who have motored recently through northern New England have seen examples of manufacturers who have established retail stores. I visited one last week at Franklin, N. H., which a local manufacturer had established in front of his mill. He gets good returns on actual sales, but he regards as the chief value of this retail store the interest and good will he is creating among the public. He is creating an additional demand for his particular brand of goods.

By these methods we have endeavored to make manufacturers in New England see that this summer business which he has hitherto regarded as meaning nothing to him really does mean something to him.

MR. KENT: Is there any unit of measure by which you can compare the magnitude of recreational with industrial business in New England?

MR. HARMON: A few sample surveys have been made, such as the average expenditure per car visiting Maine. Then there are checks made at the Canadian frontier and at the various information booths. All those things led to estimates, in terms of last year, that showed that our visitors spend about $500,000,000 a year. But these are only estimates.

We are studying, state by state, the value of the recreational industry in another way. We found in New Hampshire the assessed value of property used for recreational purposes was something like $49,000,000, and it is paying 16 per cent of all the taxes paid in New Hampshire. For all New England the assessed valuation of recreational property is $530,000,000, — a very conservative figure.

The purpose of those figures is to demonstrate to New England the economic status of our recreational interests.

MR. KENT: You regard a summer home as recreational property?

MR. HARMON: Certainly. In northern New England many a small town has been saved from bankruptcy by its tax income from summer homes.

One thing I meant to speak of is the way the Boston Society of Civil Engineers took over the problem of Flood Control in New England. I had the pleasure the other day of reading the report of your committee, and I hope at the proper time the Council can call attention to the very fine piece of work which has been done. The ideal for New England from our standpoint would be to have every group like this doing its share in a definite program for the welfare of New England.

One other thing in which you might be interested. We sent to the New England colleges and universities certain topics for research, which we thought would be helpful to New England. Last winter the head of one of the departments at Massachusetts Institute of Technology came to us and said, "We have a good many man-hours of senior students coming available this winter, and would like to sit down with you and work out topics helpful to New England, which we could approve from the standpoint of the school as desirable for these men to work on as theses." At the end of the year these students appeared before the Council and reported their results. We made and published abstracts of their theses and loaned copies of the complete texts to those specially interested.

When the Council was organized it couldn't chart a program except on the most general terms. It had no facts as to either the problem or the needs. But now we have spent five years in development work and have a good many of the facts, and know in a general way the lines along which New England can best advance. We would welcome from bodies such as this definite programs for the next five years.

MR. EDGAR S. DORR: * I would like to ask if the Council has ever considered the effect of free ports, say, for the city of Boston? Would not the establishing of a free port in or adjacent to the city promote the prosperity of the city?

MR. HARMON: The question has never been taken up with the Council, I believe. I have heard mention of it several times in connection with Boston, but I never read enough about it to form any definite conclusions of my own, and the Council has never considered it. The Council has the policy that it must concern itself only with questions common to all New England, and not take up projects of interest chiefly to a single state or city. If the question were referred to them they would immediately refer it back to Massachusetts for consideration. Far from trying to submerge the ambitions of each state, it believes each state and city should become more aggressive in promoting its own development.

MR. FRANK E. WINSOR: † For one, I feel much better informed regarding the functioning of the New England Council, and I am sure that we all want to express our thanks to Mr. Harmon for talking to us tonight.

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* Consulting Engineer, 213 Savin Hill Avenue, Dorchester, Mass.

† Chief Engineer, Metropolitan District Water Supply Commission, 24 School Street, Boston.

COLLECTION AND DISPOSAL OF MUNICIPAL REFUSE AT ROCHESTER, NEW YORK

By H. W. Baker *

(Presented at a meeting of the Sanitary Section, Boston Society of Civil Engineers, December 10, 1930)

The Department of Public Works of the city of Rochester is the largest of the four departments of the city government. It is organized into three major divisions; *i.e.*, the Commissioner's office, the Bureau of Design and Construction, and the Bureau of Maintenance and Operation.

The functions of the two Bureaus are as follows: The Bureau of Design and Construction comprises the engineering and construction functions, and its head, the Director, is Chief Engineer and Deputy Commissioner of Public Works.

The Bureau of Maintenance, under the Director, has charge of collection of ashes, rubbish and garbage; the maintenance of pavements, street cleaning, sewers, park roads, street signs, bridges, sewage disposal, garbage reduction, incineration of rubbish, sewage treatment plants, maintenance and operation of the Municipal Airport, sidewalk snow plowing, street snow removal, maintenance of motor equipment, etc. In addition to these the Director of Maintenance has general supervision of the water supply of the city and the Division of Buildings, which has jurisdiction over all new building construction, including the enforcement of the Building Code and provisions of the zoning ordinance. The Director of Maintenance also has charge of all municipal buildings and supervision of the street lighting system, and in case the Director has any spare time he can devote it to supervision of Mount Hope, our municipal cemetery.

I have outlined a few of the duties of the Director of the Bureau of Maintenance, and from now on will confine my remarks to the Division of Waste Disposal, with particular attention to the collection and disposal of ashes, rubbish and garbage.

The collections of ashes and rubbish are made at the same time, once each week from about October 15 to May 15, and once every two weeks during the summer and early fall. Ashes are collected in five cubic yard wagons in residential districts, and by truck in the business section. Ashes are taken to dumps. Rubbish is collected in horse-drawn rubbish wagons of fourteen cubic yard capacity, and is taken to a rubbish disposal plant, where it is picked over and non-salable materials burned. The heat from the incinerators passes under two waste heat boilers, and steam generated is used in the garbage reduction plant near by.

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* Commissioner of Public Works, Rochester, New York.

Garbage is collected by three and one-quarter cubic yard capacity horse-drawn wagons, and in five-ton motor trucks, depending on length of haul. Two small trucks are used for special collection. Collections are made twice each week during the summer, and once a week during the remainder of the year. Hotels, dormitories and similar institutions receive three collections per week or daily collection, depending on the need for such service.

The rubbish disposal plant, which is used for disposal of combustible refuse, is of the "Decarie" design, with scales, receiving pit, conveyor to sorting room, pressing and baling room, and furnace room containing two 50-ton incinerator units and two 220 horse power waste heat boilers, pumps, etc. This rating is for dry rubbish during a twenty-four hour period. The rubbish disposal plant was built in 1911 and cost about $140,000. It has been in continuous operation for nineteen years. The present plant is badly overloaded and the tonnage of rubbish to be disposed of has increased from 7,000 tons in 1920 to 21,800 tons in 1929, or an increase of 200 per cent. Correspondingly the cost of labor increased from $35,200 in 1920 to $53,800 in 1929, representing an increase of 50 per cent. The force required to operate the plant consists of 1 chief engineer, 1 clerk, 10 engineers and stokers, 1 handy man, 3 paper balers, 13 pickers, and 13 dump men. Rates of pay vary from 37½ to 72 cents per hour.

The salvage of material has an appeal to those not intimately connected with plant operation, but cost figures indicate that straight incineration is less costly. Salvaged materials returned $13,415 in 1920. In 1929 this return was $17,675, a decrease on a comparable tonnage basis of 135 per cent. Cost figures for 1929 indicate a loss in salvaging material of $570. One product of the incinerator is steam, which is used in the garbage reduction plant. Our steam production in 1929 was 38,000,000 pounds, having a commercial value which is credited to the incinerator of $21,000. The incinerator now supplies 25 per cent of the steam used in the garbage reduction plant, the remaining 75 per cent being purchased from the Rochester Gas and Electric Corporation.

The garbage reduction plant is of the straight Cobwell type, and is located in the geographic center of the city adjacent to the incinerator. It was built in 1920–21 by the C. O. Bartlett & Snow Company of Cleveland, Ohio. It represents an investment, including site, of $754,000, and after two years of unfortunate and unsympathetic operation was about ready either to close down or blow up. Since January 1, 1924, the machinery has been almost entirely rebuilt, its capacity increased, and it now operates in the center of the city, disposing of about 35,000 tons of garbage annually without any complaints from keen-nosed neighbors.

The process, in brief, is as follows: garbage is loaded into steam-jacketed, air-tight reducers of five-ton rated capacity. Steam is admitted to the jackets, and the garbage agitated by plow arms at the bottom of the reducer revolving at 10 r. p. m. The garbage is cooked in naptha, and the average reduction period is twenty hours. Water is driven off with the naptha vapor and condensed in refinery type condensers and sent to a separating tank from which naptha is recovered for further use.

After the cooking period, the garbage is given three washes with naptha to dissolve the grease which is pumped to steam stills, where the naptha vapor is driven off to the condenser, after which the grease is pumped to storage.

By-products of the Cobwell process are tankage (garbage residue after reduction) and grease. Tankage production in 1929 was 5,300 tons, and the average revenue was $10.10 per ton. Grease production in 1929 was 1,982,000 pounds, and the average revenue was $6.30 per hundred weight. Water used in the condensers is pumped to the adjacent steam plant of the Rochester Gas and Electric Corporation, and revenue from sale of hot water during 1929 was $7,460. The total revenue from all sources was $198,145. The net cost of disposal, capital charges and water not included, amounted to 72½ cents per ton.

The cost of collection and disposal of rubbish for 1929 was $9.11 per ton. The cost of disposal only of rubbish and garbage for 1929 was $1.24 per ton.

May I offer a word of caution regarding the use of cost figures for municipal functions. Unless one is familiar with the detailed operation of plants, and unless one takes into consideration the variants, such as topography, character and habits of population, age of plants, system of collection and disposal, interest, depreciation, obsolescense, form of government, standards of service, efficiency and interest of personnel, operating costs are not comparable between cities. In Rochester the standard is high, the personnel is above the average, and there is a personal interest in making things go. Heads of divisions are given monthly statements of expenditures, and there is a high degree of loyalty, and we have been obtaining results by team work which is seldom found in municipal government. Much credit for these results is due to Mr. John Lewis, Director of Maintenance, and to the loyalty and hard work of his men.

CHOOSING THE MEANS OF TRAVEL IN MASSACHUSETTS

By Frank E. Lyman *

The destination of the individual may determine the choice of the means of transportation in Massachusetts, some of which are more enjoyable or acceptable than others. It would appear that the 24,400 miles of roads, including city and town streets and the state highways and boulevards, offer most satisfactory ways for reaching any destination within the limits of the 355 cities and towns of the old Bay State.

The state highways include 1,630 miles of excellent road surfaces; the parkways of the Metropolitan District include 150 miles of picturesque roads; and the network of interconnecting town and city ways make approachable the whole area of the state.

Some of the more recent state highways are being built for three and four lanes of traffic, and the rules and regulations made effective on all these highways are intended to insure operating conditions safer for the thousands using them. In addition to the purely utilitarian value of these roads, attention is given to the utilization of points of advantage for obtaining beautiful roadsides and pleasing vistas.

The great value of maintaining open traffic routes in the winter is well recognized by the state in its program of keeping open 1,500 miles of state highway routes. From its experience of years the state has developed a fleet of 120 trucks equipped with snowplows and also 23 tractors, operated by an organization well trained for the task of keeping these routes cleared of snow for the full width of the highway. That fleet is put on the road shortly after the storm begins and keeps at its work until the storm is ended. Close observation of road surface conditions at times when alternate thawing and freezing or sleet storms cover the roads with ice indicates when the especially equipped trucks should be put into service for sanding the treacherous slopes and curves, as well as any desired length of road.

One's destination may be the rockbound coast, the sandy beaches or the rugged hills of Berkshire and Franklin counties. The coast of Massachusetts, following harbors and inlets, measures about 2,000 miles,

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* Commissioner of Public Works, Massachusetts Department of Public Works, State House, Boston.

of which there are about 900 miles of beaches to tempt the tourist whose state has no Atlantic Ocean to allure the stranger or to bring the oft-mentioned east wind on a sultry summer day.

Strange as it may seem, in these golden days of the motor vehicle, many are again resorting to the comfort and security of train travel for commutation between the cities and the summer resorts. Holiday and Sunday excursions to popular beaches or mountains are being arranged by the railroads so that the city dweller and the ruralist may enjoy the outings at a moderate fare.

Water travel presents its unique appeal for commutation or day excursions aside from the so-called coastwise and trans-Atlantic lines entering the principal ports. Travel on ponds, lakes and rivers is limited generally to the power boat types. Motor boats and sailing craft are moored by the hundreds at the numerous sheltered harbors of large and small extent, and furnish thrilling pastimes for multitudes of people.

Greater speed may be the desire of others, for business convenience, for pleasure, or as a time-saver on any occasion, by means of air travel. The Boston Airport, enlarged to provide runways for large machines, offers many facilities under up-to-date conditions. Regular flying services are maintained by well-known companies to and from this port. Other fields are in use, and new ones are being built or improved to meet standards of operation adopted by the state.

Mobilization, however, seems to be the modern characteristic of all persons, and the crowded highways in the height of the summer season seem not to have lost any to other means of transportation.

WHY A STATE HIGHWAY LABORATORY?

By A. V. Bratt *

In dealing with the subject of the State Highway Laboratory, it would doubtless not be amiss to consider for a moment the evolution of laboratories in general.

The early days of our industries were more or less unscientific, the manufacturing of commodities being carried on from a practical, everyday knowledge of the materials in question. This knowledge, however, was not always based on sound scientific principles, and lack of machinery made it laborious and inefficient. As time went on, more and more study and experimentation were found to be essential if industry was to progress, and there resulted "the laboratory" with its threefold duty: (1) to eliminate the element of guess; (2) to maintain uniformity and quality of material at the lowest possible cost; and (3) to research on the many problems which were bound to arise.

In considering the effects of this research, let us look back on the great industries of steel, textiles, chemicals, petroleum, coal tar and the like, and analyze their success. Was it not the laboratory that "made" them, so to speak, by utilizing by-products formerly wasted, and making them the basis of new industries? Let us consider the electrical, aircraft and automotive industries, and wonder what they would have amounted to without research effort and laboratory control. We would probably still be studying by candle light, still be riding in horse cars, and still be leaving all flying to those equipped with Nature's wings. And in the meanwhile, if laboratories had not been evolved, millions of dollars would no doubt have been wasted by the unscientific use of non-uniform materials, and, in fact, millions of lives endangered by the use of faulty materials in such enterprises as railroads and automobiles, for example, where the snapping of a weak or faulty part is almost certain to be followed by disaster.

And so today, by natural steps, we find one of the greatest of industries — the construction and maintenance of highways — calling upon its laboratory (1) to determine the quality of materials to be used; (2) to conduct research on all materials from the standpoint of service

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* Testing Engineer, Department of Public Works of Massachusetts.

value, both individually and after fabrication; and (3) to control the use of materials in the field. At first thought there may be a question, n the minds of those not familiar with materials and their adaptation, as to what a laboratory has to do with road building. To them sand, gravel and stone, and the rest of Nature's products from which our highways are built, are materially the same in quality, durability, etc. They do not seem to realize that Nature made the character of material matter just as different, if not more so, as it made human beings different, one from another, and this is saying a great deal.

In the past quarter century there has been a greater revival of interest in highway construction and maintenance than has occurred since the building of the Appian Way — two thousand years ago. This has been due, of course, to the immense increase in automobile traffic. Since the war traffic has increased so tremendously that it has necessitated larger and larger road building programs, calling for huge amounts of money. When it is realized that approximately 45 per cent of this expenditure is chargeable to materials, and the keen competition among manufacturers, dealers and contractors in the manufacture, sale and use of these materials is also considered, it is not surprising that this new and tremendous industry called for laboratory control.

Of course, specifications on all materials had to be drawn up by the laboratory, and adherence to them insisted upon, to protect both the contractor and the taxpayer. Rapid strides are being made throughout the country in standardizing specifications of materials. The materials division of the Association of State Highway Officials, the American Society for Testing Materials, the American Chemical Society, the American Concrete Institute, and others, are constantly holding meetings throughout the country in order to exchange ideas, standardize specifications, and adopt uniform methods of control. Research along this line is being continually carried on by the individual state laboratories, and by the National Research Council at Washington, with huge success.

Having considered the evolution of the State Highway Laboratory as parallel to those of other industries, let us delve into some of its work. Its primary object is to assist, of course, in the construction of highways. In so doing it must determine in each case the geological deposits of aggregates, their quality and adaptability, and research on them for possible use in various highway designs. It must also control the quality and use of all foreign materials, whether bituminous or non-bituminous, individually or in combination, and, furthermore, it must have field control to determine proper use of the material for the purpose to which it was assigned. All these factors take us into a consideration of the manufacture of the various types of highway surfacing, namely, cement concrete, bituminous macadam, bituminous concrete, and other miscellaneous types.

During the last ten or more years the laboratory has been and is yet to be a deciding factor in the development of the *Cement Concrete Roadway*. More has been written, said and done on cement concrete, whether in roadway surfacing or in structures, than on any other type. Articles and papers on this subject can be noted almost daily, throughout this and other countries. Engineers are talking concrete at practically every engineering and road building convention. These papers and talks, however, result directly from the tremendous development brought about by continual research and investigation under the control and guidance of the laboratory. They show, moreover, that the subject is still in a transitory stage. I believe the art of concrete making is still in its infancy, and that greater strides will be accomplished in the future than has been accomplished in the past. Cement concrete has been and will be, for some time yet, the subject of a great deal of investigation and research. Not only must the individual materials be inspected and guarded very closely, but the manner in which the mix is made is of equal importance. Cement concrete specifications are of little value unless the means for carrying them out from beginning to end are equally efficient, and this includes the work of the field engineer as well as that of the laboratory.

The cement concrete with which the highway department is primarily interested is, of course, the roadway slab, as well as the bridge and other masonry structures. There is no question but that concrete as used for highway surfacing is subjected to the greatest strain to which it could be put. It has many duties to perform, being called upon to resist compression, impact, surface abrasion, intermittent tension or cross-bending loads, stresses set up by freezing and thawing, wetting and drying, and finally absorption. Bridge structures and sea walls are subjected to similar destructive forces, including, in addition, constant compression, constant abrasive action of water and ice, and chemical action of the soluble salts. Therefore, with all these conditions to contend with, is it not apparent that a laboratory must be called upon as a tangible means of controlling by tests all the materials used, the mix itself, and the final mass concrete?

In 1927 I read a paper before the Highway Section of the Boston Society of Civil Engineers and I commented on the "Design and Control of Cement Concrete Mixtures" pertaining to highway surfaces. At that time I maintained that design and control could not be generally adopted y state highway departments. And why? Because economy forces us n most cases to use local sand, gravel and stone, which, although preumably suitable, will at one stage give us a definite fineness modulus, nd ten minutes later will give us another. If nature would supply hese aggregates uniformly in gradation, then there is no question about great saving in cost by increased yield with higher quality concrete. scientifically designed mix is undoubtedly of unestimated value in a entral mixing plant where conditions of control are comparatively deal, with the gradations of the aggregate controlled to maintain a niform void content.

Central mixing plants, both transit and pre-mix, have been makng considerable headway, and under the guidance of laboratory control vill undoubtedly continue to do so. I believe the small stationary nixers, within the cities, at least, will soon become a thing of the past, nd that central mixing plants, both stationary and portable, will upply the cement concrete needs of the future.

In this age of high-speed travel, conditions have demanded the inroduction of safety in roadway design, and the *Bituminous Macadam* r "Non-skid Road" as built in Massachusetts and Rhode Island has nade that possible. Here, again, the laboratory has done and still nust do its part in controlling the aggregate and bitumen that make up ts surface. Not only must the aggregate maintain a definite gradation, ut it must be quarried from the best of rock, having tough and durable haracteristics which can resist the hammering shock of heavily loaded rucks and the constant abrasion of traffic. The bitumen or cementing nedium also must have certain characteristics which the laboratory ontrols. It must be hard, yet ductile, have excellent adhesive qualiies and not be susceptible to sudden temperature changes. Of course, he ultimate success of this type of surface beyond the quality of the naterials used lies in the proper handling of these materials to bring bout the best possible interlocking effect of the stone, penetrated with he proper amount of bitumen. A new process has recently been introluced wherein the stone is first penetrated with a priming asphaltic oil efore the application of the heavy bituminous binder, giving the same urface or non-skid effect, but maintaining possibly greater adhesion of he bitumen to the stone.

Under the cloak of *Bituminous Concrete* a wide and varied range of nixtures are produced, namely, sheet asphalt, block base, bitulithic, opeka sand-oil mix, amesite, tarvialithic, tarmacmix, mac asphalt, ock asphalt and others, all consisting of hot and cold mixes of numerous ypes and kinds of bitumen, with a far greater variation in both the fine and coarse aggregates. Again the laboratory has been the deciding factor back of each and all of these mixes which have in most cases been the result of many years of research and service tests. Much, also, has been said and done on bituminous concrete mixtures. Thousands of articles have been written about them for more than a decade, and yet modernization to compete with the times has called for further research and further investigation, ever resulting in new bituminous concrete mixtures developed in most cases by co-operation between the field and the research laboratory.

Highway manufacture of today is, in other words, a huge industry analogous to other large industries whose success and development have been due in part to a control and research laboratory. And the work is far from finished.

OF GENERAL INTEREST

PROCEEDINGS OF THE SOCIETY

MINUTES OF MEETINGS

Boston Society of Civil Engineers

NOVEMBER 19, 1930. — The regular meeting of the Boston Society of Civil Engineers was held this evening in the Lounge, Boston Chamber of Commerce Building, and was called to order at 7.05 by the President, Lewis E. Moore. There were about 90 members and guests present.

Prior to the meeting about 58 members had supper in the cafeteria, in a space reserved for members of this Society.

The President announced that the minutes of the two previous meetings (September 24 and October 15, 1930) were printed in the November JOURNAL, and they were declared approved as printed.

The President announced the death of Edward Warren Henck on October 26, 1930, a member since February 16, 1927.

It was voted that the Board of Government be authorized to use the income from the Permanent Fund for the current year to such an extent as they deem necessary in payment of the current expenses of the Society.

This matter was presented at the meeting, October 15, 1930, and favorably acted upon. The present vote is the final action in the matter.

The President announced that in view of the fact that three-quarters of those voting on the choice of meeting place preferred Chipman Hall, the Board of Government has voted to return to Tremont Temple for future meetings of the Society.

The President, in announcing the subject for the evening, stated that the Society is greatly indebted to the members of the Special Committee on Floods, which has presented an extremely valuable report which was published in the September JOURNAL. By way of acknowledging this debt he read the names of the committee, and asked those members of the committee in attendance to stand, seven being present. The purpose of this meeting is to have a discussion of the outstanding features of this report in view of its bearing on problems of water supply, water power, railroads and highways in this region.

The President then called upon Mr. Arthur T. Safford, Chairman of the Committee on Floods, to take charge of the meeting.

Mr. Safford spoke briefly regarding this report, and then called upon Mr. S. S. Kent, Secretary of the Committee, to read written discussions of different phases of the report, as follows: from Mr. Clarence S. Jarvis, Philadelphia, Pa., and Mr. William P. Creager, Watertown, N. Y.

Prof. C. H. McDougal, Massachusetts Institute of Technology, presented an "Analysis of the Storm of November, 1927, by the Rational Method;" Mr. Gerard H. Matthes, Consulting Engineer, United States Engineers Office, Norfolk, Va., presented a discussion particularly regarding the flood damages and cost of preventive measures and apportionment of betterments.

Mr. Joseph W. Gross, Municipal and Reclamation Engineer, Sacramento, Cal., touched upon numerous phases of flood conditions, damages and preventive measures, referring particularly to practice and experiences in California.

The meeting adjourned at 10 P.M.

EVERETT N. HUTCHINS, *Secretary.*

DECEMBER 17, 1930. — A regular meeting of the Boston Society of Civil Engineers was held today in Chipman Hall, Tremont Temple, and was called to order by the President, Lewis E. Moore, at 7 P.M. About 100 members and guests attended the meeting.

The Secretary announced that the following had been elected to membership by the Board of Government:

Grade of Member: Arioch Wentworth Erickson, Jr.

Grade of Junior: John Wilber Copithorne, A. Albert Minichiello.

The President announced the receipt of a bequest of $1,000 from the late Clemens Herschel, the income of which is to be used for prizes for papers of merit presented before the Society.

The President presented Mr. A. B. Edwards, who arranged to secure the speakers of the evening, who then introduced Mr. Wayne Stiles, Golf Course and Landscape Architect, of the firm of Stiles & Van Kleek, who spoke on "Golf Course Design and Construction," and Mr. Arthur A. Shurcliff, who spoke on "Landscape Features of Golf Courses and Surrounding Communities." Stereopticon views were used to illustrate features described.

The meeting adjourned at 9.45 P.M.

EVERETT N. HUTCHINS, *Secretary.*

Sanitary Section

DECEMBER 3, 1930. — At 6 P.M., 29 members dined at Patten's Restaurant. At 7.30 P.M. the meeting was called to order by the Chairman, in the Societies' rooms. Fifty-six members and guests were present.

The paper of the evening, "Collection and Disposal of Municipal Refuse at Rochester, New York," was presented by Mr. Harold W. Baker, Commissioner of Public Works of that city. He described, with the aid of motion pictures, some of the activities of the Public Works Department of Rochester, particularly those of garbage collection and reduction, and refuse incineration.

Motion pictures also were shown of the city's sewage disposal plants and two interesting bridges under construction.

Mr. Baker's thorough description of these activities, together with the excellent motion pictures, provided his audience with a very complete picture of the problem and its solution at Rochester.

A rising vote of thanks was extended the speaker.

The paper was discussed by Messrs. H. P. Eddy, Sr., E. S. Dorr, and H. P. Eddy, Jr.

The meeting adjourned at 8.30 P.M.

GEORGE G. BOGREN, *Clerk.*

Designers Section

DECEMBER 10, 1930. — A regular meeting of the Designers Section was called to order at 6.10 P.M. by the Chairman, Norman P. Randlett, in the Affiliation Rooms.

The reading of the minutes of the November meeting was omitted.

The Chairman introduced as the speaker of the evening, Mr. W. M. Bassett, Engineer of Structures, of the New England Power Construction Company, who spoke about "Deformation of Concrete under Setting and Temperature Changes." Mr. Bassett discussed the steps taken to take care of shrinkage in the various concrete structures of the Fifteen Mile Falls Development of the New England Power Company, and the results as they were observed after completion of the structures. The talk was illustrated by lantern slides showing details of design and construction photographs.

At the conclusion of the talk there was general discussion.

There were 51 members and guests pesent.

The meeting adjourned at 7.20 P.M.

LAWRENCE G. ROPES, *Clerk.*

Highway Section

November 25, 1930. — A meeting of the Highway Section was held Tuesday, November 25, in the Engineering Societies' rooms.

The Chairman, James E. Lawrence, called the meeting to order at 7.20 P.M. The reading of the minutes of the meeting held October 4, 1930, were omitted, due to their publication in the November Journal.

The Chairman then introduced the speaker of the evening, Mr. Philip Ayers, Secretary of the Society for the Protection of Forests of New Hampshire. Mr. Ayers gave a very interesting illustrated talk on "The Engineer and the Beauty of the Highway." He emphasized the importance of laying out highways in a manner that would preserve the natural beauty of the countryside, and praised the gently curving parkways with central, planted areas of the Metropolitan Parks System. A discussion followed in which Messrs. Edwards, Cutter, Ingalls, Lawrence and Wilkins took part.

It was voted that the Chairman be authorized to appoint and instruct a Nominating Committee to submit nominations for the various officers of the Highway Section at the annual meeting in February.

There were fourteen members and guests present at the meeting.

The meeting adjourned at 8.30 P.M. after according Mr. Ayers a rising vote of thanks.

Ernest Mathers, *Clerk.*

Northeastern University Section

December 11, 1930. — The regular meeting of the Northeastern University Section of the Boston Society of Civil Engineers was held in Room 53H, and was called to order by the Chairman, John H. Lowe, at 7.30 P.M.

The Chairman then introduced Prof. Henry B. Alvord of Northeastern University, and Section Adviser, as the speaker of the evening.

Professor Alvord's subject was "Two Methods of Reducing Geographic Positions to Rectangular Co-ordinates." During his discourse the speaker mentioned the manner in which he became interested in this subject. Following his discourse he gave a thorough explanation of the method of procedure of the regular, or coast survey, method, and pointed out the disadvantages of this procedure.

Following this talk Mr. Louis H. Chase, engineer for Aspinwall & Lincoln of Boston, gave an historical outline of the use and method of solving such problems.

Following the speakers there was an interesting discussion during which several relatively new views were brought forward.

There were 29 members present.

The meeting adjourned at 10 P.M.

Carl H. Magnuson, *Clerk.*

APPLICATIONS FOR MEMBERSHIP

[January 20, 1931]

The By-Laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of fifteen (15) days from the date given.

For Admission

Dyer, John R., Truro, Mass. (Age 44, b. Truro, Mass.) Graduate of Wellfleet High School and later of the University of

Maine. Experience: September, 1909, to December, 1911, with Boston Elevated on subway and elevated construction work; December, 1911, to March, 1912, with Massachusetts State Department of Health on survey for Neponset River improvement; April, 1912, to June, 1913, in Attleboro as inspector and assistant superintendent on sewer construction; June, 1913, to March, 1916, with Boston & Albany Railroad as inspector on bridge construction; March, 1916, to June of same year with Fred T. Ley Company as draftsman and estimator; July, 1916, to February, 1925, with Boston & Maine Railroad as draftsman and estimator in the architect's office; since February, 1925, has carried on a general surveying business for himself in the towns on the lower end of Cape Cod, with office in Truro. Refers to *S. K. Cohen, C. B. Humphrey, A. L. Sparrow, R. D. Stafford.*

Hamill, Richard Hubbard, Lynn, Mass. (Age 23, b. Lynn, Mass.) Graduate of Lynn Classical High School in 1925, and of Tufts Engineering School in 1929. Experience: from July to October, 1927, inspector of road construction for Massachusetts Highway Department; from June to October, 1928, and September, 1929, to March, 1930, transitman for Rutland Railroad in Vermont; July, 1930, to October, 1930, draftsman and chief of party for E. N. Montague, C.E., of West Acton; October, 1930, to date, draftsman for Boston Consolidated Gas Company of Boston. Refers to *Robinson Abbott, H. P. Burden, E. N. Montague, F. N. Weaver.*

BOOK REVIEW*

"Introduction to Structural Theory and Design," by Hale Sutherland, Professor of Civil Engineering, Lehigh University; and Harry Lake Bowman, Professor of Civil Engineering, Drexel Institute. John Wiley & Sons, Inc. 1930. 318 pp. Over 200 illustrations. Price, $3.50 net.

As man's knowledge of any of the applied sciences (pure sciences and arts, also, for that matter) is extended, engineers and teachers agree upon the terminology peculiar to that science, agree as to what are the fundamentals, agree upon the method and order of presentation, and arrive at a state of stabilization wherein most textbooks upon a given subject bear a marked resemblance to one another, not only in content but in form. This is, of course, natural, as methods which have been tested by time are to be chosen in preference to methods which may be inefficient.

Once in a great while, however, even in a field which has in part become standardized, a textbook appears that sets a new standard as regards the teaching of that science. Such, with respect to structures, is Sutherland and Bowman's "Introduction to Structural Theory and Design." A prodigious amount of work has evidently gone into the preparation of the text, with results that are apparent; for, by the order of presentation of the material, the scope of the work, the abundance and clarity of the exposition, and the numerous illustrative problems, the authors have evolved a book that is a real achievement. Answers are provided to all problems, so that the college student, or the man studying by himself, can verify his computations and thus be assured that his theory is sound.

After a review of Reactions and Stresses and Graphic Statics, Roof Trusses and Bridge Trusses are discussed, the latter mainly from the point of view of influence lines and concentrated moving loads. Then follow chapters on Long Span Bridges and Lateral Systems and Portals. The above may be considered to cover structures as presented in the junior year in the average college curriculum. Then follow in full detail: Rigid Frames, employing the methods of Least Work, Slope Deflection, and Moment Distribution, Wind Stresses in Tall Building Frames, Indeterminate Trusses, Secondary Stresses, and Space Framework, both statically determinate and statically indeterminate. In the Appendix are discussed live and dead loadings on roofs and bridges, lateral and longitudinal forces, impact, and weights of roofs and bridges.

The achievement, however, does not

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* Reviewed by Frederick N. Weaver, Assistant Professor of Civil Engineering, Tufts College.

consist merely in the amount of material presented in one volume, although the book is more complete than most texts on the subject. It consists in the clearness of exposition, the choice of illustration, the numerous illustrative problems, and the number and originality of the problems for the student to solve. Many of our textbooks are excellent as far as the text itself is concerned, but unless the instructor can supply suitable problems, the text fails to meet the demands that logically may be made upon it. One test of a book is whether an able man can study the subject from the book without the aid of an instructor. The book containing few or no problems is beyond his grasp; for, while he may understand the exposition after a fashion, he cannot acquire mastery until he has solved many problems; and of course he has not the background to enable him to build up his own illustrative problems.

Professors Sutherland and Bowman have met this need by providing in each division of the subject many problems which are graded from the simple to the complex, and which range from standard types to frames which may be economically unsound, but which test a student's ability in their solution. This, to the writer, is good pedagogy, as is the assumption that the student will tackle difficult problems if he understands that their solution will advance him along his chosen path. For example, any beginnner can draw the ordinary shear and moment diagrams for simple beams, but when he has drawn these diagrams for beams with couples at both ends and at various places along the beam, he can determine reactions and equilibrium for any determinate frame. The writer has been teaching from this text for nearly three months, feels that he is giving a stiffer course than he has done in the past, and finds, to his surprise, that his students have accepted the challenge, are handling the work well, and seem to be getting a firmer grasp of the fundamentals than have previous classes.

Every instructor has his own ideas as to the best order of presentation of his subject. In Chapter IV, Bridge Trusses, the writer would first have presented trusses under moving panel loads, then counters under moving panel loads, then influence lines and concentrated load systems, feeling that his method is better adapted to the student meeting with the moving load concept for the first time. The authors state, however, "The influence line is introduced early because its use simplifies many problems, and especially reduces the space and time required for a complete treatment of bridge trusses and concentrated load systems."

While the above discussion has been from the point of view of the college instructor, the book is by no means of value only to the college student. As the authors state, "Although the arrangement is that of a textbook, the practicing engineer will find the material in convenient form for ready review, and in particular he will find useful the Bar Chain Method of Elastic Weights for the computation of truss deflections. A brief but complete statement of the important new method of rigid frame analysis introduced by Prof. Hardy Cross is worthy of professional interest. Engineers dealing with the design of tall steel buildings are requested to examine the new approximate method of wind stress analysis presented by Professor Bowman in Chapter IX. It is believed that this method gives a considerable increase in accuracy over the usual methods, with but small increase in labor."

The writer endorses the above statement, and heartily recommends the text, feeling that it is an excellent book both for student and for engineer. He also knows that unqualified praise is apt to be discounted as indicating lack of judgment. In this particular case, however, he merely invites the skeptic to read the book and judge for himself.

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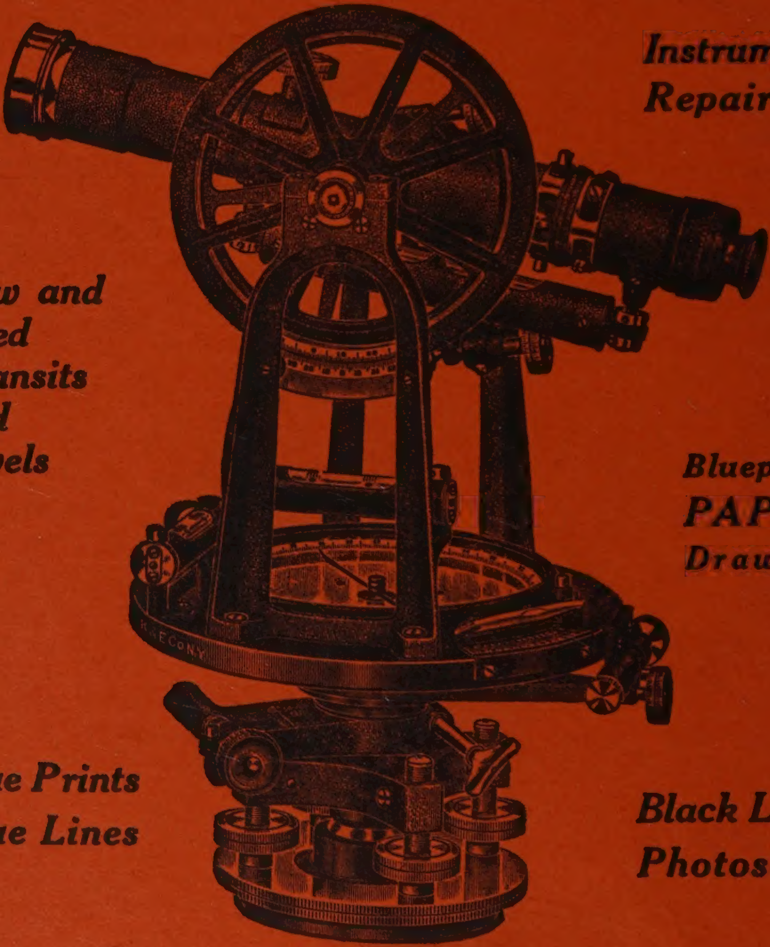

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